BEFORE THE PUBLIC UTILITIES COMMISSION OF THE

STATE OF HAWAII

In the Matter of PUBLIC UTILITIES COMMISSION Instituting a Proceeding to Investigate the Implementation Of Feed–in Tariffs.	DOCKET NO. 2008-0273

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BLUE PLANET FOUNDATION'S RELIABILITY STANDARDS

AND

CERTIFICATE OF SERVICE

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BLUE PLANET FOUNDATION'S RELIABILITY STANDARDS

Blue Planet Foundation ("Blue Planet"), by and through its attorneys Schlack Ito Lockwood Piper & Elkind, and pursuant to the Commission's October 29, 2009 Order Setting Schedule, hereby submits its proposed reliability standards.

I. DISCUSSION

Reliability-related measures adopted in this proceeding pursuant to the Commission's September 25, 2008 Decision and Order ("D&O") should ensure the feed-in tariff ("FIT") achieves its purpose of dramatically accelerating renewable energy acquisition in Hawaii.[1] To best achieve the FIT's purpose, interconnection and curtailment of renewable

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[1] As more fully explained in Blue Planet Foundation's Comments on Proposed Tiers 1 and 2 Tariffs filed January 21, 2010, the purpose of the FIT is not simply to provide another renewable energy procurement mechanism. As the Commission has noted, the FIT is needed in part to remedy the ongoing failure of existing mechanisms to procure sufficient amounts of renewable energy. *See, e.g.* D&O at 13 ("a FIT is needed for the following reasons: . . . 'only 4% of HECO's sales (Oahu) were supplied by renewable energy, and 96% were supplied by imported fossil fuels.'"). Rather, the purpose of the FIT is to dramatically accelerate renewable energy use in Hawaii. The second sentence of the D&O declares that FITs are approved to "<u>accelerate</u> the acquisition of renewable energy." *Id.* at 1 (emphasis added). The D&O further cites to the Commission's October 24, 2008 Order Initiating Investigation, which likewise affirms: "[The Energy] Agreement is a commitment on the part of the State and the HECO Companies to <u>accelerate</u> the addition of new, clean resources on all islands[.] . . . Included in the Agreement is a commitment by the HECO Companies to implement feed-in tariffs "to <u>dramatically accelerate</u> the addition of renewable energy from new sources" and to "encourage increased development of alternative energy projects." D&O at 2-3 (emphasis added) (citations omitted); *see also id.* at 5 (Statement of Issues includes best design for FITs to "<u>accelerate</u> and increase the development of Hawaii's renewable energy resources[.]"); *id.* at 14 (according to the parties, a FIT will encourage "<u>accelerated</u> acquisition of renewable energy"); *id.* at 15 (FIT may "<u>accelerate</u> the acquisition of renewable energy"); *id.* at 42-43 (Commission's desire to "<u>accelerate</u> the adoption of renewable energy" outweighs HECO Companies' project size concerns).

energy Hawaii should be governed by formal bulk electric system[2] reliability standards based upon existing North American Electric Reliability Corporation ("NERC") bulk electric system reliability standards, modified as may be necessary and appropriate for Hawaii island grids. If formal reliability are not adopted in this proceeding, Blue Planet respectfully requests the Commission to adopt Blue Planet's proposed Hawaii Bulk Electric System Reliability Principles and FIT initial system caps, as discussed below, and to direct the HECO Companies[3] to collaborate with stakeholders to develop formal bulk electric system reliability standards.

A. Interconnection and Curtailment of Renewable Energy in Hawaii Should be Governed by Formal Reliability Standards.

Although Federal Power Act provisions concerning electric reliability standards do not apply in Hawaii, the HECO Companies' bulk electric system planning and operations, including decisions concerning the interconnection and curtailment of renewable energy providers, should be governed by formal reliability standards. *See* 16 U.S.C. § 824o(k) (provisions of 16 U.S.C. § 824o do not apply to Alaska or Hawaii). First, all electric utilities in the United States (except for Hawaii and Alaska) are legally bound to comply with reliability standards enforced by the NERC. *See* 16 U.S.C. § 824o(c)(1) (concerning development and enforcement of "reliability standards that provide for an adequate level of reliability of the bulk-power system[.]") Reliability standards are planning and operating rules that utilities follow to ensure system reliability. These standards are developed using a stakeholder-driven process managed by the NERC Standards Committee. Once approved by the U.S. Federal Energy Regulatory Commission ("FERC"), NERC reliability standards become legally binding on all owners, operators and users of the bulk power system. NERC has the legal authority to enforce

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[2] Bulk electric system refers to electrical generation and high voltage transmission systems and associated equipment. *See* NERC Glossary of Terms Used in Reliability Standards at 2, *available at* http://www.nerc.com/files/Glossary_12Feb08.pdf

[3] Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc., and Maui Electric Company, Limited.

compliance with NERC reliability standards, which it achieves in part through the imposition of financial penalties. NERC reliability standards are utilized by electric utilities throughout the United States, Canada, and portions of Mexico. *See* About NERC: Company Overview.[4]

Second, the reasons compelling widespread utilization of the NERC reliability standards throughout North America apply with equal force in Hawaii. Although operational challenges in Hawaii may require modification of NERC reliability standards, the basic physical and operational characteristics of electric grids in Hawaii and North America are essentially identical. All utilities must maintain adequate voltage, balance supply and demand in real time, and maintain system stability.

Third, the experience of New Zealand demonstrates that formal reliability standards are appropriate and utilized not only in North America, but on isolated island electric grids similar to those in Hawaii. The electric system in New Zealand consists of two separate island grids with limited interconnection via a high voltage direct current undersea cable. The bulk power electric system is subject to formal reliability standards established by the New Zealand Electricity Commission. *See* New Zealand Electricity Commission (reliability standards).[5] These New Zealand standards are comparable to NERC reliability standards governing North America. For example, under New Zealand reliability standards, "Principal Performance Obligations," or PPOs, establish real-time reliability standards (i.e., system frequency and voltage control) the bulk electric system operator must comply with to ensure reliable operation of generation and transmission. *See* New Zealand Electricity Commission (performance obligations).[6] Similarly, grid reliability standards set forth the requirements for the design and upgrade of the high voltage transmission system; these requirements are analogous to

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[4] *Available at* http://www.nerc.com/page.php?cid=1|7
[5] *Available at* http://www.electricitycommission.govt.nz/opdev/transmis/gridreliability/index.html#grs
[6] *Available at* http://www.electricitycommission.govt.nz/pdfs/rulesandregs/rules/rulespdf/partC-20Jul09.pdf

NERC reliability standards related to transmission planning. *See* New Zealand Electricity Commission (reliability standards).[7] The grid system operator is also required to submit monthly system performance reports to the Electricity Commission. The reports must summarize power system performance, including compliance with system frequency PPOs. *See* New Zealand Electricity Commission (performance reports).[8]

Finally, formal reliability standards based on the NERC reliability standards and are appropriate to guide Hawaii's transition to electric grids supplied by increasing amounts of renewable energy. Grid reliability has emerged as a central issue in this proceeding. Specifically, the potential impact of increasing amounts of intermittent renewable on the electric grids has been linked to interconnection and curtailment of renewable energy in the FIT program. The potentially contentious nature of this issue demands formal reliability standards and operating practices tailored for Hawaii. Formal reliability standards (such as the NERC standards) may be particularly valuable in Hawaii because they provide an objective basis to assess any grid reliability impacts and ensure reliable grid operation. Based on the foregoing, Blue Planet respectfully requests the Commission to direct the HECO Companies to collaborate with stakeholders to develop formal bulk electric system reliability standards, based on (i) existing NERC formal reliability standards (modified as may be necessary and appropriate for Hawaii island grids), and (ii) Blue Planet's proposed Hawaii Bulk Electric System Reliability Principles, discussed below.

B. The Decision and Order Supports Adoption of Formal Reliability Standards to Achieve the Purpose of the Feed-in Tariff Program.

The D&O provides specific guidance concerning the scope and role of reliability-related standards or measures to ensure the FIT achieves its purpose of dramatically accelerating

[7] *Available at* http://www.electricitycommission.govt.nz/opdev/transmis/gridreliability/index.html#grs.
[8] *Available at* http://www.systemoperator.co.nz/f1947,26087875/so-system-perf-report-dec-09.pdf.

renewable energy acquisition in Hawaii. In general, the standards are to be developed to maintain system reliability. *See, e.g.*, D&O at 16 ("given Hawaii's isolated island grids, the commission must consider reliability and system stability[.]".); *id.* at 44 (HECO Companies have a "continuing obligation to ensure system reliability."). The standards should complement existing standards, such as Tariff Rule 14H. D&O at 50.

Consistent with the purpose of the FIT, a key directive of the D&O is that the standards should facilitate displacement of fossil fuel generation. *See* D&O at 51 ("FIT generation should . . . displace fossil fuel generation.). Similarly, the standards should not "meaningfully displace" existing renewable energy generation. *Id.*

The standards also should provide greater transparency and predictability with respect to reliability issues for developers in order to reduce developer risk. The Commission:

> recognizes the need of developers for <u>transparency</u> with respect to what the reliability and interconnection standards are that may preclude a project from being implemented under the FIT. . . . [and] is concerned, though, that without some <u>transparency</u> and <u>predictability</u> in reliability determinations, <u>developers are unable to gauge the probability that their projects could be developed, which increases the developer's risk</u>.

D&O at 50 (emphasis added).

Standards should define most circumstances in which FIT projects can or cannot be incorporated on each island. D&O at 50. As the D&O explains, the Commission "in particular wants the HECO Companies to adopt standards that establish when additional renewable energy can or cannot be added on an island or region therein without markedly increasing curtailment, either for existing or new renewable projects." *Id.* at 50-51. The standards alone, however, shall not be absolutely dispositive in determining whether to include or exclude projects from FIT eligibility. *See* D&O at 51 (If reliability standards indicates project is not viable in a location, developer may request and pay for reliability standards studies to assess project feasibility). Accordingly, the HECO Companies may refuse to interconnect a FIT project based on reliability standards. Under the D&O, the HECO Companies may refuse to interconnect projects that will "substantially compromise reliability[.]" D&O at 44 (emphasis added); *id.* at 44 n. 83 (HECO Companies "retain the ability to reject FIT projects that would compromise system reliability"); *id* at 44 (Standards may be used by the utility to "determine that projects above certain sizes or using certain technologies are not possible in certain locations without degrading reliability or necessitating costly system upgrades.").

Finally, the standards should be flexible and responsive to experience and changes in system conditions. D&O at 51. They should be modified after each year of the FIT, or more frequently if appropriate, to reflect changes to "transmission, distribution, generation, demand, generation mix, ancillary services availability, the results of ongoing studies, and any other relevant factors." *Id.*

C. The Commission Should Adopt Hawaii Bulk Electric System Reliability Principles and FIT Initial System Caps, If Formal Reliability Standards Are Not Adopted in this Proceeding.

It is unclear whether there is sufficient time under the current procedural schedule for adoption of Hawaii-specific formal reliability standards (based upon the NERC reliability standards) in this proceeding. The D&O appears to acknowledge that significant time may be required to develop reliability standards. *See* D&O at 50 ("While the commission prefers that the standards be filed prior to FIT rates taking effect, the commission will entertain proposals from the parties on an alternate means or timeline for completion of the standards within fourteen days of the date of this Decision and Order."). Similarly, Sopogy has recommended that the Commission "initiate a process or . . . direct the HECO Companies to initiate a process to develop reliability standards" because:

> [t]here are currently no system reliability standards adopted or applicable to the HECO Company systems that are meaningful in determining the amount of distributed generation or as-available generation that can be accommodated without adversely affecting service reliability. There are no standards that can serve to determine what demand response, load management, energy storage or grid improvement measures could mitigate or accommodate increasing levels of distributed and/or as-available generation.

D&O at 48 n. 86 (citations omitted). If Hawaii-specific formal reliability standards (based on the NERC reliability standards) are not adopted in this proceeding, Blue Planet requests the Commission to adopt reliability principles and initial system caps.

1. Blue Planet's proposed Hawaii Bulk Electric System Reliability Principles.

The Commission should adopt reliability principles, drawn from the NERC definition of "Adequate Level of Reliability," for Hawaii to guide and inform (i) the adoption of initial FIT system caps in this proceeding, and (ii) the future development and adoption of formal reliability standards (assuming formal standards are not adopted in this proceeding).

As noted above, the Federal Power Act requires development and enforcement of "reliability standards that provide for an adequate level of reliability of the bulk-power system[.]") *See* 16 U.S.C. § 824o(c)(1) (emphasis added). In its January 18, 2007 Order on Compliance Filing, FERC directed NERC to file a plan for defining the term "adequate level of reliability." *See* Order on Compliance Filing, 118 FERC ¶ 61,030 at para. 16. In developing the definition of "adequate level of reliability," NERC noted that its traditional definition of "reliability" was ubiquitous throughout the electric utility industry and consists of two fundamental concepts: adequacy and operating reliability. *See* Letter from D. Cook (NERC) to Hon. K. Bose (FERC) dated May 5, 2008 at Attachment B, p. 5, attached as Exhibit A. "Adequacy," according to NERC, is the ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components. "Operating reliability" is the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system components. *Id.* Accordingly, NERC identifies six characteristics describing when a bulk power system will achieve an "adequate level of reliability." *Id.*

Blue Planet submits that these six characteristics may serve as reliability principles guiding and informing the adoption of initial FIT system caps in this proceeding and the future development and adoption of formal reliability standards. The six proposed reliability principles are as follows:

Proposed Hawaii Bulk Electric System Reliability Principles

1. The system is controlled to stay within acceptable limits during normal operations.
2. The system performs acceptably after credible contingencies.
3. The system limits the impact and scope of instability and cascading outages when they occur.
4. The system's facilities are protected from unacceptable damage by operating them within facility ratings.
5. The system's integrity can be restored promptly if it is lost.
6. The system has the ability to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components.

See Letter from D. Cook (NERC) to Hon. K. Bose (FERC) at Attachment B, p. 6, attached as Exhibit A. In support of the foregoing proposed Hawaii Bulk Electric System Reliability Principles, Blue Planet refers to and adopts the technical discussion of the characteristics of each of the six items as set forth in the NERC materials concerning the formal definition of "Adequate Level of Reliability." *See id.* at Attachment B, pp. 8-10.

2. Blue Planet's proposed initial system caps.

Consistent with the proposed Hawaii Bulk Electric System Reliability Principles, Blue Planet proposes the following initial FIT system caps for consideration by the Commission in this proceeding.

a. HECO

For the Hawaiian Electric Company, Inc. ("HECO"), Blue Planet recommends a system cap identical to the FIT program cap established by the D&O of nameplate capacity equal to five percent of 2008 peak demand. *See* D&O at 55. On Oahu, four percent of HECO's sales were supplied by renewable energy and 96% were supplied by energy from imported fossil fuels. *See* D&O at 13. Given the HECO program cap of nameplate capacity equal to five percent of 2008 system peak demand, system reliability issues for HECO during the initial two-year FIT appear unlikely.

b. HELCO and MECO

For the Hawaiian Electric Light Company, Inc. ("HELCO") and the Maui Electric Company, Limited ("MECO"), Blue Planet recommends the following. First, for the first full year of the FIT, limit FIT projects for each company to nameplate capacity equal to 2.5% of the 2008 system peak demand. Second, upon completion of the first full year of the FIT, increase the limit on FIT projects for each company to nameplate capacity equal to 5.0% of the 2008 system peak demand, unless the HELCO and/or MECO are able to establish that the increase of the limit to 5.0% will result in a violation of formal reliability standards, assuming formal reliability standards governing HELCO and MECO have been adopted at that time.

Blue Planet supports the foregoing approach because it is likely to avoid placing undue limitations on FIT projects, thus ensuring a successful FIT program that dramatically accelerates the acquisition of renewable energy. Increased frequency fluctuations are not expected to be significant if for the first full year of the FIT project sizes for each company are limited to nameplate capacity equal to 2.5% of the 2008 system peak demand. In addition, under proposed amendments to Tariff Rule 14H, HELCO and MECO will require additional frequency ride-through capability for new solar PV inverter systems. *See, e.g.,* Application of Hawaii Electric Light Company, Inc., for Approval to Modify Rule 14H – Interconnection Of Distributed Generating Facilities Operating In Parallel With The Company's Electric System As Shown in Appendix I, II, and III (Transmittal No. 10-01H) dated Feb. 8, 2010.

D. Additional Actions by the HECO Companies Should Supplement the Reliability Principles and Initial System Caps.

In addition to adopting reliability principles and initial system caps, Blue Planet recommends that the Commission require the HECO Companies to take certain steps regarding ancillary services and related factors to ensure that reliability-related considerations facilitate successful achievement of the FIT's fundamental purpose of dramatically accelerating renewable energy in Hawaii. Ancillary services are provided by flexible, standby capacity resources (both generation and non-generation resources) and enable system frequency and voltages to be maintained in real time by balancing supply and demand and controlling reactive supply. The amount of required ancillary services is established by reference to system reliability standards. Ancillary services are thus critically important and directly linked to reliability standards and the integration of increased amounts of renewable energy.

The HECO Companies should be required to enable non-generation resources such as demand response ("DR") or interruptible load, and new technologies such as battery and flywheel storage and electric vehicles, to supply ancillary services. Increased renewable energy will require increased ancillary services. The HECO Companies should be required to reconfigure their ancillary services supply portfolio by substituting non-generation for fossil generation resources. DR resources in particular can supply system operating reserves and are non-fossil fuel resources with highly desirable technical attributes. For example, DR resources provide immediate frequency response benefits as contrasted with slower generator AGC or automatic generator control frequency response performance. Similarly, the HECO Companies should define unbundled ancillary services product characteristics and provide unbundled avoided cost prices in order to provide market signals to developers to incorporate ancillary service characteristics into renewable energy projects, or to propose stand alone projects.

Excess renewable energy should exist only to the extent that a minimal level of fossil generation must continue to operate in order to meet bulk power reliability standards by providing ancillary services. The HECO Companies should utilize, to the maximum extent possible, non-fossil generation resources to provide ancillary service (operating reserves), in conformance with applicable reliability standards, to minimize required operation of fossil generation.

In addition, the Commission should direct HECO Companies, in conjunction with customers and other stakeholders, to initiate various actions to minimize future creation of excess renewable energy. For example, the HECO Companies could develop and encourage additional load to be shifted from on-peak to off-peak periods to provide a sink for otherwise curtailed renewable energy through time-of-use rates. The HECO Companies should coordinate with large demand customers, such as water and wastewater facilities, which may be able to transfer blocks of load from on-peak to off-peak periods in real-time, in order to utilize otherwise curtailed renewable energy through real time spot pricing mechanisms. Wind generators that otherwise are curtailed off-peak are capable of providing certain ancillary services such as regulation down reserve. Instead of raising fossil generation output levels in order to provide regulation down reserve, wind generators should be permitted to do so and paid the applicable unbundled ancillary service rate.

II. CONCLUSION

For all of the foregoing reasons, if formal bulk electric system reliability standards based on existing NERC formal standards (as modified for Hawaii) are not adopted in this proceeding, Blue Planet respectfully requests the Commission to adopt its proposed Hawaii Bulk Electric System Reliability Principles and FIT initial system caps, and to direct the HECO Companies to collaborate with stakeholders to develop formal bulk electric system reliability standards.

DATED: Honolulu, Hawaii, February 8, 2010.

DOUGLAS A. CODIGA
Attorney for Blue Planet Foundation

NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

May 5, 2008

Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

RE: Definition of "Adequate Level of Reliability"

Dear Secretary Bose:

The North American Electric Reliability Corporation (NERC) submits solely as an informational filing the definition of "adequate level of reliability" that the NERC Board of Trustees approved on February 12, 2008 (Attachment A). NERC also submits a background paper prepared by the NERC Planning and Operating Committees the board considered in the process of approving the definition (Attachment B). NERC is not requesting the Commission to take any action on this definition.

The Commission directed NERC to consider and propose methods for ensuring Reliability Standards provide for an adequate level of reliability and for defining "an adequate level of reliability" in its "Order Certifying North American Electric Reliability Corporation as the Electric Reliability Organization and Ordering Compliance Filing" (July 20, 2006; 116 FERC ¶ 61,062, P 240). This letter explains the status of that effort.

The officers of NERC's Planning and Operating Committees and NERC staff developed a strawman definition of "adequate level of reliability" that NERC posted for industry comment on October 1, 2007. NERC received comments from 44 organizations and individuals during the 30-day comment period. NERC's Member Representatives Committee discussed the definition during its October 22, 2007 meeting. Based upon the comments received, the committee officers and NERC staff revised the definition and submitted it to the Planning and Operating Committees for approval. Those two committees approved the revised definition at their December 12–13, 2007 meetings. Following further discussion at the February 11, 2008 Member Representatives Committee meeting and consideration of a written minority opinion, the NERC Board of Trustees approved the revised definition on February 12, 2008.

NERC expects to include the definition in its three-year reliability standards work plan and use the definition when considering gaps or shortcomings that might exist in the set of currently effective reliability standards. NERC does not expect to use the definition to determine whether an individual reliability standard being developed through the NERC standards development process meets the requirements for reliability standards stated in section 215 of the Federal Power Act and the Commission's regulations and orders. In short, NERC will use the definition as a guide to whether or not the standards, taken as a whole, promote "an adequate level of reliability."

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EXHIBIT "A"

As directed by the Commission in its January 18, 2007 Order on Compliance Filing (118 FERC ¶ 61,030 (2007), P 16), NERC is also working with industry stakeholders to develop and apply metrics for identifying and tracking key reliability indicators, including general metrics for the characteristics of "adequate level of reliability." This will enable NERC to benchmark reliability performance and measure reliability improvements that result from its other programs.

Sincerely,

David N. Cook

David N. Cook
Vice President & General Counsel

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Attachment A

Characteristics of a System With an Adequate Level of Reliability

1. The System is controlled to stay within acceptable limits during normal conditions.

2. The System performs acceptably after credible Contingencies.

3. The System limits the impact and scope of instability and cascading outages when they occur.

4. The System's Facilities are protected from unacceptable damage by operating them within Facility Ratings.

5. The System's integrity can be restored promptly if it is lost.

6. The System has the ability to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components.

(Note: Capitalized terms are taken from the NERC Glossary of Terms Used in Reliability Standards.)

Approved by NERC Board of Trustees
February 12, 2008

Attachment B

NERC
NORTH AMERICAN ELECTRIC
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Definition of "Adequate Level of Reliability"

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Preface

In its January 18, 2007 Order on Compliance Filing, the Federal Energy Regulatory Commission directed NERC to file a plan for defining the term "adequate level of reliability."[1] The Commission explained that it intended to use this definition when judging the merits of NERC's Reliability Standards against the requirements of Section 215 (c) of the Federal Power Act. The Act requires Reliability Standards "that provide for an ***adequate level of reliability*** of the ***bulk-power system*** [emphasis added]."[2]

The Commission required NERC's plan to include two broad objectives and address several questions:

- First, the plan needed to develop a definition of adequate level of reliability using a stakeholder process. The Commission asked whether the proposed definition be applied to all Reliability Standards, certain sets of standards, or, in some cases, be tailored for each standard. The Commission also asked NERC to consider opportunities to develop and apply metrics that can form the basis for broadly defining an adequate level of reliability.
- Second, the plan needed to "propose a continuing improvement process to consider 'adequate level of reliability' when developing new or modified Reliability Standards."

In its March 19, 2007 response to the order, NERC explained that it directed its Operating Committee and Planning Committee to develop the definition of adequate level of reliability through a stakeholder process and provide that definition to the NERC Board of Trustees.[3] NERC also explained that it would "integrate the approved definition into its three-year standards work plan and standards development process, as well as its compliance monitoring and enforcement program as appropriate."

This document, prepared by the NERC Operating Committee and Planning Committee, fulfills NERC's commitment to provide a definition of adequate level of reliability to the Board of Trustees.

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[1] *Order on Compliance Filing*, 118 FERC ¶61,030, paragraph 16.

[2] The definition of Bulk-Power System, as it appears in Section 215(a)(1) is: "the facilities and control systems necessary for operating an interconnected electric energy transmission network or any portion thereof; and the electric energy from generation facilities needed to maintain transmission system reliability."

[3] *Compliance Filing of the North American Reliability Corporation in Response to January 18, 2007 Order and March 9, 2007 Order*, March 19, 2007, Docket Nos. RR06-01-003 and RR06-01-005, pp. 4-7.

Introduction

NERC prepared this document to define the term "adequate level of reliability" as requested by the Federal Energy Regulatory Commission. While the definition itself is succinct, the fundamental concepts from which NERC derived the definition are complex and deserve discussion, which we have provided in this document.

The document begins by discussing the term "reliability" that NERC has used since its creation in 1968. It then explains how the Federal Power Act's definition of "reliability" as it pertains to NERC's standards differs from NERC's broader, traditional definition.

The definition of adequate level of reliability follows. Then the document explains the concepts behind each statement in the definition.

Capitalized terms are terms defined in the NERC Glossary of Terms or in Section 215 of the Federal Power Act.

Definition of "Reliability"

NERC's traditional definition of "reliability" was ubiquitous throughout the electric utility industry, and consists of two fundamental concepts—adequacy and operating reliability:

> **Adequacy** is the ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components.[4]
>
> **Operating reliability**[5] is the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system components.

The NERC Operating Policies and Planning Standards were based on these concepts, and most of those policies and standards were translated into NERC's Reliability Standards.

We will be using the Section 215 term "Bulk-Power System" instead of the NERC Glossary of Terms definition "Bulk Electric System" because, as cited in the preface, the first expression is specifically used in Section 215(c) in the context of "adequate level of reliability." However, in Order 693 (March 16, 2007), the Commission stated that "for at least an initial period, the Commission will rely on the NERC definition of bulk electric system and NERC's registration process to provide as much certainty as possible regarding the applicability to and the responsibility of specific entities to comply with the Reliability Standards in the start-up phase of a mandatory Reliability Standard regime."

More recently, the term *adequacy* has prompted considerable discussion among NERC members. In Section 215 to the Federal Power Act, NERC and FERC are not authorized "to set and enforce compliance with standards for adequacy ... of electric facilities or services."[6] In the U.S., states may set adequacy requirements. On the other hand, the Act requires NERC to *assess* the future adequacy and reliability of the Bulk-Power System.

NERC continues to believe the term *reliability* must include the concept of adequacy. Therefore, our definition addresses adequacy.

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[4]From the May 2007 NERC Glossary of Terms

[5] NERC had used the term "security" until September 2001 when security became synonymous with homeland protection in general and critical infrastructure protection in particular. To remedy the increasing confusion over what we meant by security, NERC replaced that term with "operating reliability." Operating reliability is not a definition in the NERC Glossary of Terms but instead is a reliability concept that predates the ERO.

[6] Section 215(h)(i)(2). The term "adequacy" is not defined in the Section 215. For this reason, we are not capitalizing the term in this document even though it is defined in the NERC Glossary of Terms.

Definition of "Adequate Level of Reliability"

The Bulk-Power System ("System") will achieve an adequate level of reliability when it possesses following characteristics:

1. The System is controlled to stay within acceptable limits during normal conditions;
2. The System performs acceptably after credible Contingencies;
3. The System limits the impact and scope of instability and Cascading Outages when they occur;
4. The System's Facilities are protected from unacceptable damage by operating them within Facility Ratings;
5. The System's integrity can be restored promptly if it is lost; and
6. The System has the ability to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components

General Discussion

The System exhibits an adequate level of reliability when it possesses these six characteristics. Some of the terms such as "acceptable limits" and "acceptable performance" require specificity in order to be applied. These specifics will be included in the Reliability Standards that support each objective. We recognize that NERC's standards cannot require a specific level of adequacy for "electric facilities or services."[7]

Metrics

The definition of adequate level of reliability is broad enough to apply to all possible NERC standards, and therefore it is not based on specific metrics. However, NERC will develop metrics at the System level that will track performance of these characteristics. These System performance metrics will be different from metrics in a standard which are used to determine compliance. System performance metrics will provide feedback for improving the Reliability Standards. They will help identify reliability gaps and point to existing standards that need to be modified or new standards that need to be developed.

Cost effectiveness

The definition of adequate level of reliability does not mention any specific measure of "cost effectiveness" because costs versus benefits, including societal benefits, can only be determined by the individual users, owners, and operators. They will have different perspectives on what is "cost effective" for them, and they will exercise their judgments by participating in the standards

[7] Ibid.

drafting process, and ultimately, when they cast their ballots to approve or reject a standard.[8] A goal of the standards is to achieve an adequate level of reliability across North America. For various reasons, some users, owners or operators may choose to plan and operate their portion of the System to achieve a level of reliability that is above the standards.

[8] In the NERC Rules of Procedure, Section 302 (3) addresses performance requirements for standards and references "costs and benefits." It states: "Each [performance] requirement is not a "lowest common denominator" compromise, but instead achieves an objective that is the best approach for bulk power system reliability, taking account of the costs and benefits of implementing the proposal." These "cost and benefits" are not explicitly developed. Ultimately, the ballot body, which decides on standards, decides on its cost effectiveness.

Technical Discussion

This section explains each characteristic in the definition.

1. The System is controlled to stay within acceptable limits during normal conditions.

Acceptable limits include voltage and frequency limits as well as System Operating Limits. System Operating Limits specify the ranges of line flows, system voltages, and generator loading that must be followed to maintain operating reliability. The system planner must design the System so it can be operated within all limits (voltage, frequency, and System Operating), but the operator must operate within limits in real time that are based upon existing conditions.

2. The System performs acceptably after credible Contingencies.

System planners and operators cannot prevent Contingencies from happening. But they can plan and operate the System so that when credible Contingencies do occur, their effects are manageable, and the consequences are acceptable. In essence, planners and operators design and operate the System to minimize the risk that credible Contingencies (as defined by NERC's standards) will result in unacceptable performance.

Are acts of nature Contingencies? Not per se. They are events that trigger Contingencies. Lightning, a contaminated insulator, a brush fire, or an airplane crash can all trigger a line fault. Depending upon the probability of occurrence, the triggered Contingencies may or may not be classified as "credible."

The generation and transmission systems are finite and limited and always will be. At some point, the failure of a significant number of transmission Elements will cause part of the System to become unstable and lose its integrity[9], regardless of automatic protection systems or system operator actions that attempt to contain the event. Such extreme events are generally not considered credible. While managing (or minimizing) risk is the goal, it is unreasonable to assume that utilities can build or operate the System to eliminate *all* risks. However, by focusing on credible Contingencies, we define the risks we want to manage.

It is also unreasonable to assume that every disturbance, event, or equipment failure will result in unacceptable performance. For example, if we know (not simply assume) the failure of a particular Element (line, breaker, transformer, etc.) has little or no effect on the integrity of the surrounding transmission network and does not impact service (except for service directly associated with the failed Element), then the risk if the Element fails is acceptable. Likewise, the loss of firm load does not always equate to unacceptable performance. At times, operators must shed firm load to maintain the integrity of the System or protect equipment from unacceptable damage. The measures of acceptable performance and categories of credible Contingencies, and

[9] By "integrity," we mean the synchronous connectivity of the generators and network connectivity of the transmission lines.

how they relate to each other, are specified in the Reliability Standards. The standards will define what is "credible" and "acceptable" and what is not.

3. The System limits the impact and scope of instability and Cascading Outages when they occur.

System planners design the System so that events such as transmission line and transformer faults, breaker and switch failures, and generator trips are contained to prevent these events from Cascading and causing the system to lose its integrity. For example, substation circuit breaker configurations are designed to isolate transmission equipment failures so their impact is limited and the failures do not cascade into widespread System failures. Back-up relays are employed to isolate an Element in the event that the primary protection scheme fails. Underfrequency and undervoltage load shedding systems help limit instability and Cascading Outages.

It does not matter whether the triggering event causing instability and Cascading Outages was a credible Contingency (that should have been contained) or an extreme event. We still want to limit its impact and scope.

4. The System's Facilities are protected from unacceptable damage by operating them within Facility Ratings.

Protecting generation and transmission equipment from unacceptable damage may be obvious because NERC establishes standards on operating within Facility Ratings. The definition of adequate level of reliability specifically states this important characteristic because failure to protect equipment could result in unacceptable reliability for weeks or months due to the long-lead time for replacing or repairing equipment.

Not withstanding characteristics 1 and 2, this characteristic is necessary. Extreme events not addressed in other characteristics can destroy or severely damage Facilities unless properly designed and maintained protection and control systems are employed. If necessary, operators must be able to shed firm load to protect Facilities from unacceptable damage.

5. The System's integrity can be restored promptly if it is lost.

The System must be planned and operated so that it can also be restored promptly, whether after a Cascading Outage or widespread damage from natural disasters. System planners must include blackstart and synchronizing facilities in their plans. System operators must have a restoration plan ahead of time, and know from studies, training, on-line tools, and experience the operating limits they need to stay within while restoring the system, and how those limits change through the stages of reestablishing system integrity, and up to normal interconnected operations. During the restoration process, they must protect generation and transmission system equipment from unacceptable damage by operating within Facility Ratings, not jeopardize adjacent parts of the System that are operating normally, and coordinate their restoration efforts with other interconnected entities, including Load-Serving Entities.

6. The System has the ability to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components.

This characteristic implies the concept of "adequacy" as defined in NERC's Glossary of Terms, and includes generation and transmission assets as well as Demand-Side Management. As written, the use of the phrase "at all times" does not imply 100% reliability since it is premised upon "scheduled and ***reasonably expected*** unscheduled outages of system components [emphasis added]." A System that has adequate resources (generation, Demand-Side Management, and transmission) and that also meets the other five characteristics above would have an "adequate level of reliability." NERC is required to assess and report on the adequacy and reliability of the System under Section 215(g).

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE

STATE OF HAWAII

In the Matter of PUBLIC UTILITIES COMMISSION Instituting a Proceeding to Investigate the Implementation Of Feed–in Tariffs.	DOCKET NO. 2008-0273

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this date a copy of the foregoing document was duly served upon the following individuals by placing a copy of same in the United States Mail, postage prepaid, and/or by electronic service, as follows:

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